National Aeronautics and Space Administration

NASA Advisory Council: ESMD

Presented by: Doug Cooke
Associate Administrator
NASA's Exploration Systems Mission Directorate
February 18, 2010

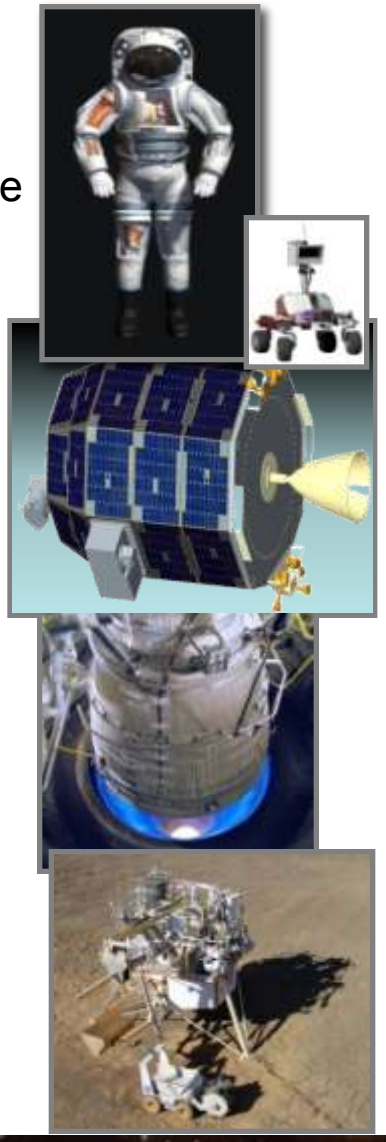
The Federal Budget FY 2011

The President's budget will invest an additional $6 billion in NASA over the next five years- an overall $100 billion commitment to the agency

- Enable the agency to embark on an ambitious 21st century program of human space exploration with bold new approaches that invests in the building blocks of a more capable approach that includes:
  - Research and development on heavy-lift and propulsion technologies
  - Transformative technology development and flagship technology demonstrations to pursue new approaches to space exploration;
  - Robotic precursor missions to multiple destinations in the solar system;
  - U.S. commercial spaceflight capabilities;
  - Cross-cutting technology development aimed at improving NASA, other government, and commercial space capabilities;
  - Extension and increased utilization of the International Space Station;
  - Future launch capabilities, including work on modernizing Kennedy Space Center after the retirement of the Shuttle;
  - Accelerating the next wave of Climate change research and observations spacecraft; NextGen and green aviation; and
  - Education, including focus on Science, Technology, Engineering and Math (STEM).

Exploration Research and Development

- The budget includes three new robust exploration programs:
  - Technology demonstration program, $7.8 billion over five years.
    Funds the development and demonstration of technologies that reduce the cost and expand the capabilities of future exploration activities, including in-orbit refueling and storage.
  - Heavy-Lift and Propulsion R&D, $3.1 billion over five years.
    Funds R&D for new launch systems, propellants, materials, and combustion processes.
  - Robotic precursor missions, $3.0 billion over five years.
    Funds cost-effective means to scout exploration targets and identify hazards and resources for human visitation and habitation.
- The budget also enhances the current Human Research Program by 42% and supports the Participatory Exploration Program at $5 million per year (for activities across many NASA programs).



ESMD's Lead Role in Exploration

- Critical Technology Demonstration
  - Flagship demonstration program
  - Enabling technology development program
- Heavy Lift and Propulsion Research and Development
  - Seeks to both reduce costs and shorten development timeframes for future heavy-lift systems
  - Targeted research and development activities to include:
    - New propulsion approaches;
    - In Space advanced engine technology development and demonstrations; and
    - Foundational-basic- propulsion research
- Robotic Precursor Missions
  - Send robotic precursor missions to scout locations and demonstrate technologies to increase safety and capability of future human missions and provide scientific dividends
  - Missions may include demonstration of moon landings with robots tele-operated from Earth or In Situ Resource utilization




Commercial Crew and Cargo

- NASA will accelerate and enhance its support for the commercial spaceflight industry
- Building off successful progress in the development of commercial cargo capabilities the budget invests $6 billion over five years to spur the development of American commercial human spaceflight vehicles.
- NASA will allocate these funds through competitive solicitations that support a range of higher- and lower-programmatic risk systems and system components
- NASA will set standards and processes to ensure that all systems meet the agency's stringent human-rating requirements to maintain the highest level of safety

Cancellation of Constellation Program

- The FY 2011 budget cancels the Constellation program
- Working with Congress, NASA will strive to close out the existing Constellation contracts as soon as possible.
- NASA has created study teams to assess workforce, procurement and other issues, which will report to the Administrator over the coming months

Approach to Teams

- Total of Nine Study Teams Stood Up
  - 5 pre-formulating new programs
  - 1 assessing transition of Constellation
  - 3 Agency cross cutting teams

- What the Teams are Doing
  - Providing inputs for very near-term products needed to support required reporting to OMB, Congress and others
  - Developing options for overall program strategy, identifying needs and goals, exploring alternate implementations, establishing high level milestones and a budget profiles
  - Focusing on planning at the program level, generally not specific projects or missions
  - Helping tee up decisions for SMC and/or A Suite

- What the Teams are Not Doing
  - Program execution, assigning work ,or defining Center participation and management of programs
  - Developing or awarding new contracts
  - These decisions will be made through ESMD and Agency decision processes

Constellation Transition Team

Develop options and recommendations for rapid and cost effective ramp down of the Constellation Program. This includes assessing the impact to existing contracts, government workforce, support contractor workforce, and institutional services and facilities.

- **Olson, John** HQ (Team Lead)
- Rathjen, Tom HQ
- Clay, Bob HQ
- Morton, Steve HQ
- Kearns, Joel HQ
- Soltess, Bob HQ
- Bellinger, Frank HQ
- Hecker, Mike HQ
- Ortegal, Kevin HQ
- Barber, Scott HQ
- Stegemoeller, C JSC
- Hamm, Linda JSC
- Thomas, Wayne JSC
- Kunz, Jennifer JSC
- Davis, Danny MSFC
- Grant, Helen HQ
- Gallina, Tony HQ
- Steven, Mary HQ
- Dorris, Clinton JSC
- Stockman, Patti HQ
- Henry, Thad MSFC
- Lengyel, Dave HQ
- Bounds, Phil HQ
- Palmer, Jennifer HQ
- Edwards, Ashley HQ

Flagship Technology Demonstrations Team

Formulate plans for a series of in-space demonstrations that validate next generation capabilities key to sustainably exploring deep space.

- **Conley, Mike** HQ (Team Lead)
- Neumann, Benjy HQ
- Troutman, Pat LaRC
- Hefner, Keith MSFC
- Patterson, Michael GRC
- Tooley, Craig GSFC
- Leck, Renee HQ
- Whipple, Art GSFC
- Bromley, Linda JSC
- Davis, Steve MSFC
- Seery, Bernie GSFC
- Grant, Helen HQ
- TBD

Enabling Technology Development and Demonstration Team

Formulate plans for conducting smaller scale development and testing of key, long-range exploration technologies.

- **Moore, Chris** HQ (Team Lead)
- Neumann, Benjy HQ
- Peri, Frank LaRC
- Culbert, Chris JSC
- Craig, Doug HQ
- Hughes, Peter GSFC
- Mercer, Carolyn GRC
- Johnson, Les MSFC
- Larson, Bill KSC
- Tu, Eugene ARC
- Kempisty, Annette HQ
- Barta, Dan JSC

Heavy Lift and Propulsion Technology Team

Formulate plans for a program that will investigate a broad scope of R&D activities to support next-generation space launch propulsion technologies. This includes foundational propulsion research and demonstrations of first stage and in-space engines.

- **Guidi, Cris** HQ (Team Lead)
- Alexander, Reggie MSFC
- Bowles, Dave LaRC
- Brown, Kendall, MSFC
- Cikanek, Harry, GRC
- Daumbacher, Dan MSFC
- Lyles, Garry MSFC
- Morris, Bruce HQ
- Pendley, Earl MSFC
- Ray, Ron HQ
- Sumrall, Phil MSFC
- Timm, Marc HQ

Exploration Robotic Precursors Team

Formulate plans for a series of robotic precursor missions to scout targets for future human activity. Potential destinations include the Moon, Mars and its moons, Lagrange points and nearby asteroids.

- **Jenkins, Jay** HQ (Team Lead)
- Neumann, Benjy HQ
- Wargo, Mike HQ
- Garvin, James GSFC
- Klupar, Pete ARC
- May, Todd MSFC
- Hertz, Paul HQ
- Adams, Jim HQ
- Roura, Corali HQ

Commercial Crew Team

Formulate plans to expedite and improve robustness of current COTS solutions. In addition, develop a plan that supports the development of commercial crew transportation providers to whom NASA could competitively award a crew transportation services

- **Yoder, Geoff** HQ (Team Lead)
- Graham, Courtney HQ
- Pagel, Lee JSC
- Lindenmoyer, Alan JSC
- Healey, DeeDee HQ
- Hecker, Mike HQ
- McAlister, Phil HQ
- Leuders, Kathy JSC
- Bauer, Frank HQ
- Wagner, Rosie HQ
- Burnett, Josie KSC
- Archambault, Lee JSC
- Hale, Wayne
- Timm, Marc HQ

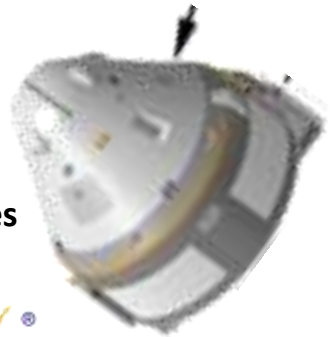
Commercial Crew Development
Space Act Agreement Awards

Blue Origin

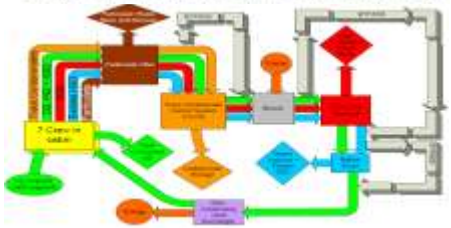
Mature Pusher Escape System and Composite Pressure Vessel

BOEING

Mature system architecture and design through SDR and demonstrates key technologies



PARAGON
SPACE DEVELOPMENT CORPORATION



Mature Air Revitalization System (ARS) design through PDR level and Manufacture and test an engineering development unit

ULA
United Launch Alliance

SNC SIERRA NEVADA CORPORATION
Space Systems

Complete SRR, Build & Test Spacecraft Engineering Test Article, Build & Fly Scale Model for A&L Tests, OMS Motor Build & Test, RCS Thruster Proto Build & Test, TPS Trades, and Atlas V Integration

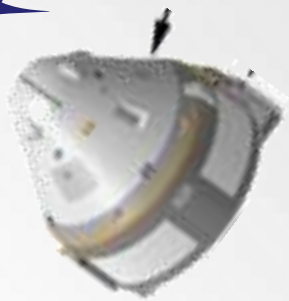
Comprehensive maturation plan for commercial crew launch vehicles includes addition of modular Emergency Detection System (EDS) which can be used with Atlas V, Delta IV, and other LVs including prototype EDS testing and demo

Portfolio of Commercial Crew & Cargo Space Act Agreement Partners

Commercial Crew Development New Space Act Agreements

Blue Origin

BOEING

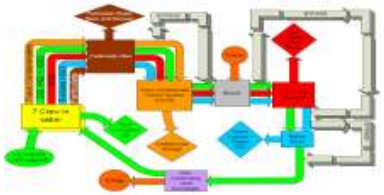


Existing COTS Demo and CRS Partners for the ISS

SPACEX

Orbital

PARAGON
SPACE DEVELOPMENT CORPORATION



snc SIERRA NEVADA CORPORATION
Space Systems

ULA
United Launch Alliance

Cross Cutting Study Teams

- **Integration Team**
  - To integrate all the data collected across the study teams
    - Lead by **Mike Hecker** HQ
- **International Team**
  - To infuse and incorporate international opportunities into the new program
    - Lead by **Kathy Laurini** JSC
- **Participatory Exploration Team**
  - Agency team to increase public participation and coordination of NASA wide efforts to incorporate participatory exploration into future missions.
    - Lead by **Kathy Nado** HQ

Summary

- NASA ambitiously continues to explore space and open new frontiers
- We will make key investments in new and innovative technologies that will expand our exploration opportunities, reduce mission costs, contribute NASA innovation to broader national needs, and grow the American economy by creating new high tech jobs.
- We have study teams in place and working to be responsive to very near term needs
- We are working closely with the NASA Centers and the Center Directors
- We continue to support and work closely with the NAC especially with NAC Exploration Subcommittee
- We will revitalize an excitement for NASA to young people across the nation to engage and participate in this 21st century space program through education and outreach